Amanda BRIGGS-GOODE, Tina DOWNES & Nigel MARSHALL
The Nottingham Trent University, UNITED KINGDOM

Digital Textile Futures: Integration of New Technologies

Context

Textile design as a substrate enables, mediates and supports our life experiences in a myriad of forms and needs. It is currently experiencing unprecedented activity by scientists, technologists, designers, artists who are exploring new potentials which hold more meaning, or improve qualities of experience for the user (Lee 2007, Braddock-Clarke & O'Mahoney 2007, Colchester 2007). The possibilities which emerge from this research are changing the way we view textiles themselves. As educators this is leading us to question the way in which we teach and engage our students with the subject area of textile design. We have noticed, anecdotally, that that the jobs and placements that our students apply for demand more reference to the breadth of textile design rather than one textile subject. The aim of this research project was therefore to engage with the integration of the digital technologies that we currently have within our programme, BA Textile Design, through print, embroidery and weave and look at ways that we can integrate them to facilitate our subject and produce more innovative and meaningful textile design resolutions (Lee 2007. Through this we aim to contribute to critical debates within textile design education and to the well being of our subject and industry. The impact of this cross-boundary knowledge transfer has potential to have a high value to the industry as they will have designers who are more prepared for dialogue across the traditional boundaries.

The emerging digital technologies within the field of textile design have been rapid in recent years (Braddock Clarke 2007). To support the design and manufacturing experiences of our print, weave and embroidery students, the following technologies

have been purchased in the last 5 years: a Miramaki 2 Textile Digital Printer, a Barudan Multi-head Embroidery Machine and a Dracup Samplemaster Jacquard Loom. Currently our students experience these technologies within the isolated context of their textile specialism of print, embroidery or weave. These traditional areas of textile design has there own specific history, tradition, methodologies and visual languages and the technologies themselves create different resulting marks, textures, qualities the question of how tacit knowledge is built up is significant to enable understanding and sharing of knowledge. While the input data to all of the digital technologies is the same the ways of developing, thinking and responding to the process of design and manufacture is not. Therefore these common digital technologies offer an opportunity to explore the technologies holistically as there is little evidence of research into differences of integration into design practice at subject specific level, nor how design approach and image interpretation may be compared and contrasted. These technologies interpret, process and develop images in different ways through ink droplets (inkjet printing), stitch (multi-head) and through yarn construction (jacquard loom). This research aims to initiate debate about the potential of sharing knowledge across traditional textile disciplines.

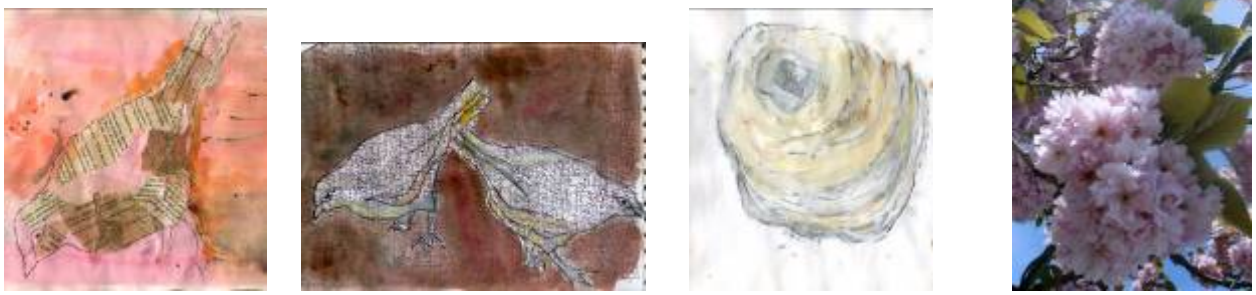
Methodology

This research project begins to explore and analyse how textile design specialists work with these technologies, process visual information in different ways and analyse imagery. The research project was led by the three authors (Briggs-Goode – Print, Downes – Embroidery, Marshall – Weave) and supported by two undergraduate students who had just completed their second year (Katie Aston – Print and Claire Goodwin – Embroidery). These students were appointed with a university SPUR project fund which we applied for (Scholarship Projects for Undergraduate Researchers). The purpose of which was to engage undergraduates in research focused activity as well as inform and develop clear research enhanced teaching strategies.

We had enough funding to support the two students for 6 weeks each on 4 days a week and this took place during June and July 08 (We actually made a decision to work with

two students for six weeks rather than one student for ten weeks based on the idea that collaboration might enhance the quality of outcome). We wanted to put in place some parameters which would enable us to compare and contrast the qualities that were produced we therefore identified a range of image qualities and fabric weights. We utilised work from Aston and Goodwin's sketchbooks of photographic, linear, tonal and textural qualities and made a decision to use a light, mid and heavy weight fabrics (In print – silk chiffon, cotton sateen and upholstery velvet and in embroidery - cotton velvet, cotton drill, cotton organdie and silk georgette) and yarns. We also decided that we would use a black and white monotone palette to ensure that we were not distracted in our analysis by colour combinations. Training was given to the students on all 3 technologies, as neither student was based in weave a more intensive experience was undertaken, the first week was spent in weave, while the 2nd was split with 2 days in embroidery and 2 days in print. This was followed by a 3rd week of experimentation with little staff interaction due to their attendance at New Designers in the London The following 2 weeks was one of more integrated use of the technology with full team discussion and analysis. The last week became focused around Aston and Goodwin writing an evaluation of the experience and of the work they had produced.

Aston's images.



Goodwin's Images

These parameters, we considered, would enable us to analyse how designers might consider design development of appropriate imagery through a particular technology and then the impact of this technology upon design resolution in the case of print, stitch and woven textiles. We will demonstrate here that this has led to a clearer method of communication across the technologies and a more direct engagement in cross-technology dialogue.

<u>Approaches to Digital Printed Technology</u>

Technology employed

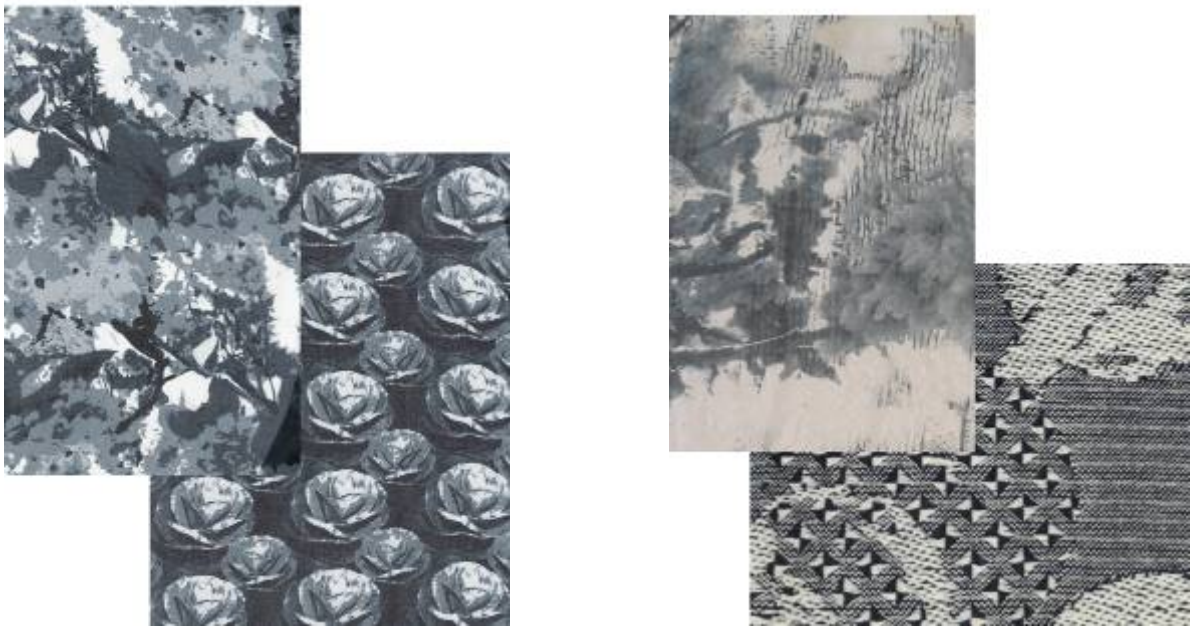
CAD: Photoshop creative suite

CAM: Mirimaki 2 Textile Digital printer

In this area the technology was the most familiar to the students they have in the 1st year of our programme an excellent grounding in Photoshop (and often arrive with CAD skills) followed by further opportunities in year 2 as well as an induction into Illustrator. We have a dedicated digital print technician and due to the demand on the printer from other sources it was not felt appropriate that the students had direct experience with the printer. This did mean that print created a slightly different kind of experience for the students. It therefore had the smallest learning curve, held the least drama for the results of the printed image (all 1st years take a design through to digital print) and it is fair to say that the printed image

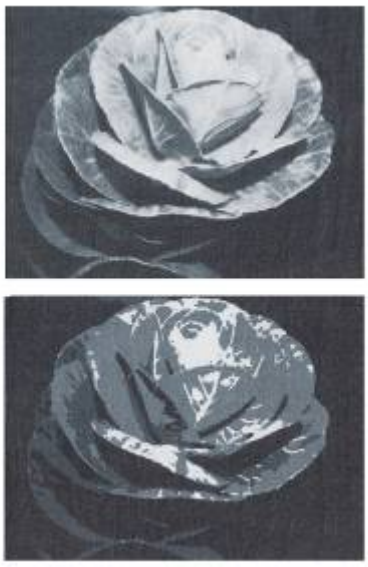
is much more readily accessible in terms of design context and cultural reference than stitch or weave.

Aston was equipped with some advanced Photoshop skills as part of the 'technical block' she had received within the print area in the 2nd year. This meant that she had developed abilities around production strategies, colour palettes, repeat and colour separations, as well as further skills in image manipulation, creation and integration with Illustrator. Whilst having had these experiences, Aston was able to manipulate, explore and develop imagery. Whilst Goodwin, as an embroiderer, found the qualities she wanted to explore difficult to generate and the focus on imagery too literal.



Complex and simple repeats and trompe loiel print of stitch and weave.

They explored how both simple and complex repeats can be created in Photoshop by layering and offsetting imagery. They also explored colour reduction of the colours in a photographic image whilst seeking to maintain its photographicness. They explored image manipulation through both layering imagery and through integrating some of the woven samples into printed designs and printing heavy woven designs onto silk, playing with trompe loiel effects



Colour reduction to maintain photographic integrity and digital print of art work notice loss of detail.

Digital print is essentially a reproductive tool rather than an interpretative one and essentially it should be expected that it will print your imagery exactly, in reality this is not always the case, and fabric qualities do also change image qualities. Some aspects that they found more challenging was to do with not being able to print white and this reduces the range of coloured backgrounds that you can use. We do not have access to any CAM software for the students to use prior to digital printing apart from a RIP (Raster Image Processor) driver from whom we purchased the printer and as the driver for the printer is essential. They recognised that they had less personal input during the printing process than they did with the multi-head for instance. Colour management with this technology is always difficult and colour accuracy and the loss of some of the fine details was a concern for them more so on some fabrics than others. Aston and Goodwin do draw our attention to the fact that some types of image appear to work better on some fabrics. Whether this is to do with fabric settings in the RIP or fabric qualities in terms of surface quality or the ink reaction to the fabric is hard to tell.

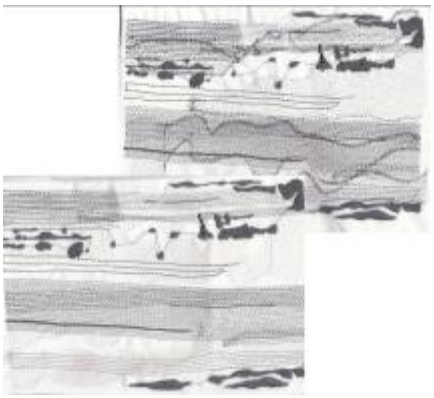
Upholstery velvet and cotton sateen digital print

Approaches to Digital Embroidery Technology

Technology employed:
CAD: Wilcom ES65 Designer V.9 embroidery software
CAM: Barudan multi-head embroidery machine

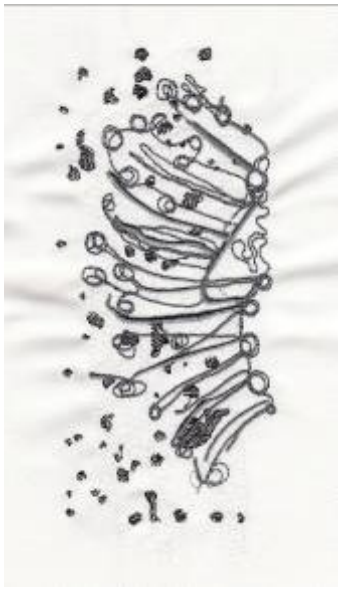
The multi-head embroidery machine has developed rapidly in recent years to mass produce placement embroideries for fashion and interior applications. The machine features multiple heads with aligned fabric frames and multiple needles to allow for colour changes within the design. are inserted as a backdrop into the embroidery programme Here the designs are interpreted into stitch by the embroidery designer (or digitiser) in a process known as digitising. Whilst the embroidery software is capable of making some interpretations, these are often crude; more aesthetic judgements and subtle effects can be achieved by the skilled decisions of the digitiser. Their art lies in designing considered, flowing routes through the embroidery design, selecting stitch lengths, widths, densities, types

and angles to sensitively translate imagery, all whilst maintaining a focus on the fabric type and weight that the design will be stitched onto; whereas the computer screen provides a hard, static interface, the fabric has a life of its own and may stretch or distort during the embroidery process.

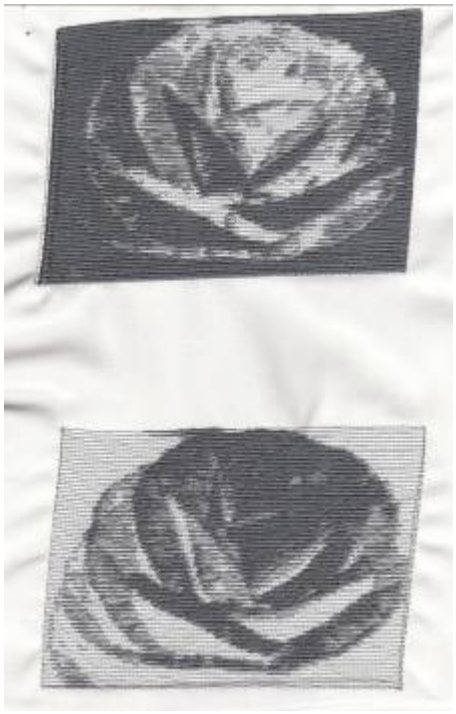


Flower head in four stitch types in cotton drill and textural background using fill stitches on velvet

The two student researchers focused initially on interpreting their designs through drawn qualities using diverse linear stitches, then on using fill stitches to create textural backgrounds, filled areas and form. Due either to diverse personal interests, prior training and skills, or both, the questions they asked of digital embroidery processes were different. Aston aimed to reproduce imagery as exactly as possible in stitch. She selected cotton drill as a base to embroider upon; this static, unrelenting fabric interfered with image quality the least. Using stitch, she tried to capture diffused droplets of colour in the background of a layered design. For a number of reasons, this was difficult to achieve: Whilst tonal qualities could be created by opening out embroidery density in areas, the stitching became too linear to capture the diffused quality in the art work. Also, hundreds of separate embroidery shapes created problems with tension as the machine stopped and started every few seconds to tie off one shape and start the next. To reproduce this kind of artwork entirely in stitch would lead to many stylistic adaptations and loss of image integrity.



Small separated embroidery motifs and increasing scale and decreasing stitch density



Having discovered how difficult photorealism is to achieve in embroidery, the software provides its own interpretation in the form of the *photosmart* tool. This works by reducing colour to monotone and stitching the image in a linear fashion, almost like an inkjet printer. Tonal qualities of light and shade are created by varying the stitch width and density of each line from run stitch to satin stitch. The over all effect is of a stiff, heavy-weight, woven upholstery fabric.

In other ways, applying ‘print-thinking’ to embroidery created novel effects. Separating colours into layers, as if for traditional screen printing, rather than into areas as in paint-by-numbers, Aston stitched background shadows and then stitched lighter colours on top. It is not a usual manufacturing methodology to build up dense layers due to cost, time and handle but by carefully opening out the stitch density of the layers, handle is increased and the visual effect is of an embroidered design with printed detail.

Goodwin took a more interpretive approach to embroidery translation. She saw her art work as an inspirational starting point and was less concerned with achieving a literal reproduction of imagery. She demonstrated that fabric selection could emphasise mood within drawings or paintings, for instance, selecting chiffon to emulate the transparency of water colours. By placing shirring elastic in the bobbin case, she also manipulated the surface of the fabric. When it was released from the embroidery frame it recreated forms within her painting. To capture collage effects from her sketch book, Goodwin considered the preparation of the fabric ground before and during the embroidery process. By sandwiching loose threads between two layers of cotton organdie, the naive style of the stitched outline was exaggerated and a random factor was added to the design process. Similarly, in another trial, fragments of fabric were placed on the surface of the fabric frame and caught into the stitching as the needle traced the design onto the backcloth. When faced with photographic imagery, Goodwin placed it as a backdrop in the software for personal interpretation considering appliqué, tracing outlines in linear stitches and selecting areas to interpret using filling stitches.

<u>Approaches to Digital Jacquard Weaving</u>

Technology employed

CAD – Pointcarre software v

CAM – Dracup Sample Master Jacquard Power Loom

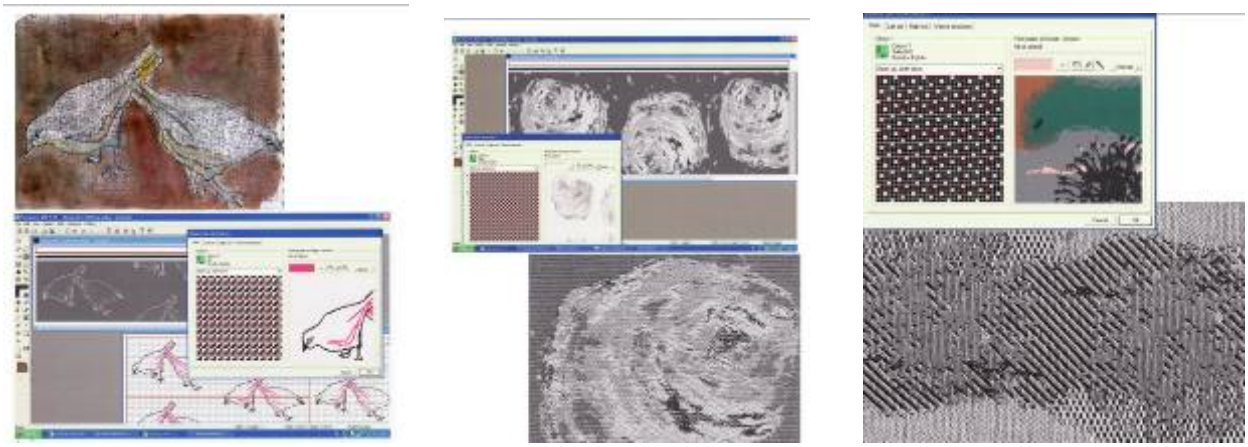
The development of woven fabrics has been explored through the use of two key technologies for design development and fabric production. The initial developmental stages have used Pointcarre software, which is a specialist design programme that has been specifically developed for woven textiles. The production of the woven fabric is through the use of a Dracup Sample Master jacquard power loom, which is widely used within the industry. The Pointcarre software allows for two distinctly clear stages to be explored before the actual weaving takes place, these being:

- Idea and design generation through digital media. Using this stage to establish a variety of design work that is a direct translation of the visual research.
- Design options stage and a variety weave structures are applied, thus transforming the design from artwork to cloth. – turning shape and pattern into structure.

On completion of these stages the design can then be taken through to power weaving production. What the Jacquard power loom allows to take place is the generation of image based woven fabrics, which is very difficult to produce through other forms of weaving. It's within this area that it starts to question and explore the notion of how weave and image can be explored.

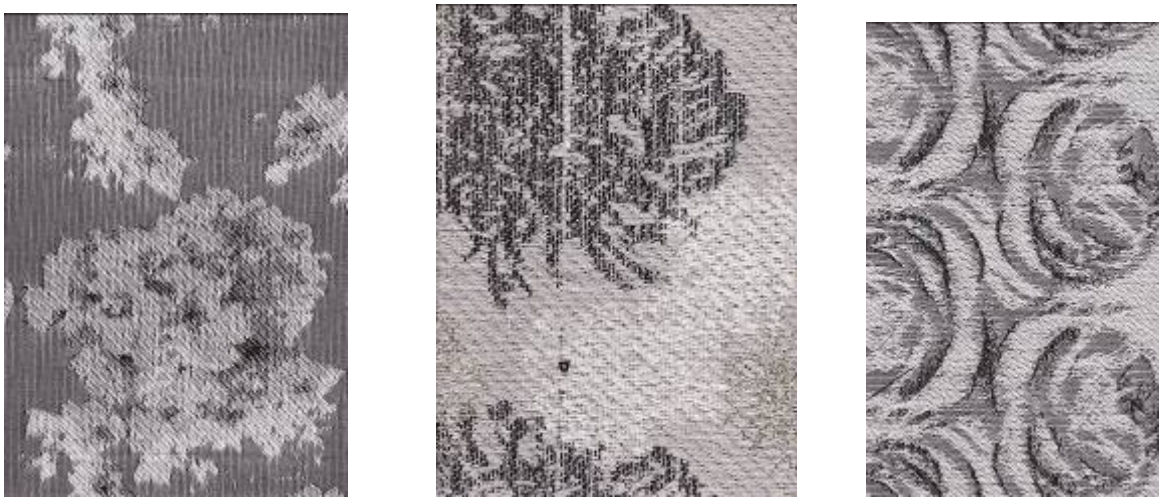
For the purpose of the project and in response to how the loom has been set up with a predetermined warp, this posed restrictions on the variety in weights of fabric being achieved. What this provided was a clear set of parameters to be established once a general understanding of yarn qualities and fabric structure had been established. Though the warp yarns could not be changed, a good variety of fabric qualities of a similar fabric weight could be achieved through weft selection. Building upon this understanding of relationships between digital developments and jacquard weaving, the main focus then explored the use and interpretation of image. Early investigations highlighted that more weave knowledge about jacquard was required to enable a more level imagery to be created within weaving and also maintain higher levels of detail. This also meant that when working with digital imagery at the artwork stage, you need

to have an understanding of the level of detail that could be achieved once translated and woven. It was identified that developing design work in photo shop in the initial stages first, because this was a more familiar design programme to use and also offered a wider range of options for design development. Once the design had then been developed it was then imported into Pointcarre where it could be refined further and then translated into weave.



Loss of detail, simulation and too many colours in the image.

Building upon this experience it was identified that some images translated more readily in to Jacquard weaving than others. This also took into account the warp and weft yarns being used within the fabrics. The images that had a combination of clear shape and image, plus textural qualities proved the most successful. Images that had fine line detail, and of a smaller scale, did not work as well in terms of definition. However once the scale of the image was enlarged it created more surface area to work with, enabling more detail to be included.



Conclusions

It became apparent that Photoshop acted as a linking design tool between the print, embroidery and weave technologies and could enhance image qualities prior to translation through weave and embroidery software. Specifically it was identified as being essential to maintaining colour integrity and detail, that repeat could be used at that stage to create more complex repeats before moving into the specialist software and as such it was a vital translation tool.

Analysing the student's responses to the process of translating images through the different textile technologies provided clues to the unexamined differences in design thinking between the specialist areas: Print – high level of image manipulation skills with priority and emphasis placed on resolve in composition, repeat structure, colour palette prior to digital printing; Embroidery – more interpretive approach to translating drawn qualities into stitch with multiple aesthetic and technical decisions being made during the digitizing process – this time-consuming task possibly diverts attention away from the quality of the image in the first place. The student has to have some experience of the digitizing process to understand how best to design embroidery and then needs to go back to developing the image further with new knowledge. Further interventions that will affect the quality of image can also be made during and after the production process. Weave – biggest leap required to understand how structures become marks and create stable fabrics – a structure library would provide a useful teaching aid for this. A degree of interpretation is again required to translate imagery and an iterative process of testing and adapting ideas before a successful resolve is reached. They found it easier in print and embroidery to change fabric weights than in weave.

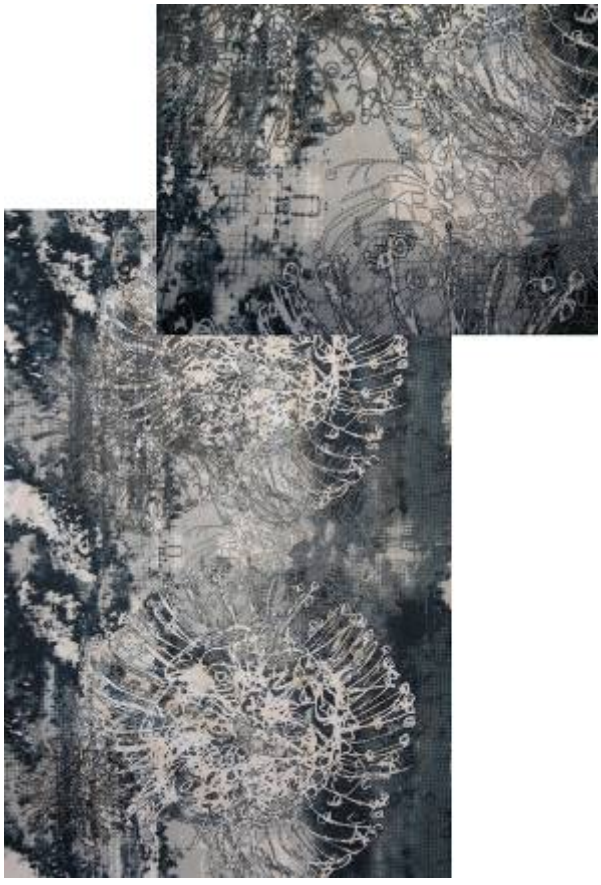
The students also began to push the technologies and play with a range of possibilities such as applying a structure when using extra weft which resulted in long floats of yarn that could then be cut away. In embroidery interesting effects could be achieved by

considering how to layer stitches in the same way that you might layer screens in hand printing. They also were keen to apply some aspects of spontaneity by adding treads or pieces of fabric as the stitching process was happening. They also talked about 'tricking' the technology into stitching without thread to create texture.

The selection of two student researchers with prior experience in print and embroidery made it easy to compare the skills exchange possible between the two areas – a trade between advanced image manipulation skills from print with greater understanding of the role fabric selection and manipulation plays in enhancing the mood of an image from embroidery. This project would have been enhanced by a third student with greater weave experience to make a fair comparison – unfortunately funding did not allow for this. It is possible to surmise though that, similar to embroidery, weavers develop high levels of tacit ability to select appropriate yarns to create designs where image sits not just on the surface but forms the fabric.

One of the benefits of this project has been the collective learning that has occurred through specialists working together across subjects. This suggests that one of the outcomes may be to consider not only how individual students can work across subject boundaries but how student specialists might collaborate to enhance their design outcomes and add to the vitality and well being of the industry.

Below: left to right – digital print and appliqué, weave and embroidery, print and embroidery and finally a felted woven and stitched fabric



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